Name \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Class \_\_\_\_\_\_\_\_

**Chapter 18-2 Guided Notes (Part 2)**

**Daily Objectives** - \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Derived Characters**

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ focuses on certain kinds of characters, called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, when assigning organisms \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- A derived character is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the \_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a particular lineage and gets \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**-** Whether or not a character is derived depends on the \_\_\_\_\_\_\_\_\_\_\_\_ at which you’re \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, for example, is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ character for the \_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- \_\_\_\_\_\_\_\_\_\_ is a derived character for the clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but \_\_\_\_\_\_\_\_\_ limbs is *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_* for mammals. If it were, \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ would have four limbs!

- Specialized \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a derived character for the clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—of which both the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_ are members.

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_ hair nor four limbs is a derived character \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ character for the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the \_\_\_\_\_\_\_\_ ). Notice that \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, but coyotes do not.

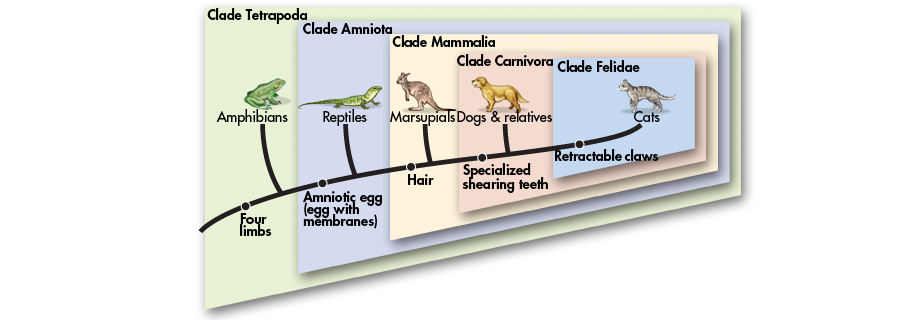
**Losing Traits**

- Organisms can \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over time so systematists are cautious about \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- For example, both \_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_ have \_\_\_\_\_\_\_\_\_\_\_ the tetrapod character of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_—but they are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- Snakes are members of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, while \_\_\_\_\_\_\_\_\_\_ are members of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Reading Cladograms**



- This cladogram shows a simplified \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the \_\_\_\_\_\_\_\_ family.

- The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ represents the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of all \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ animals—members of the clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- The \_\_\_\_\_\_\_\_\_\_\_ show the order in which \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ over the course of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the derived characters on the cladogram \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_ in which those characteristics \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- The trait of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, for example, appeared \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the history of the cat’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- Each derived character \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. Hair, for example, is a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ character for the clade Mammalia.

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is a derived character shared only by \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of the clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- Derived characters that appear “\_\_\_\_\_\_\_\_\_\_\_\_” on the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for a clade are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ for that particular clade.

- \_\_\_\_\_\_\_\_\_, for example, is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ character for the clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

- \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are \_\_\_\_\_\_\_\_\_\_\_\_\_\_ within the larger clades.

- Clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is part of the larger clade \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Clades and Traditional Taxonomic Groups**

- A clade must be monophyletic.

- This means that it contains an ancestral species and all of its descendants, and no species that are not descendants of that ancestor.

- Linnaean class Mammalia, for example, corresponds to clade Mammalia.

- Analysis of cladograms shows that many traditional taxonomic groups do form valid clades.

- In other cases, however, traditional groups do not form valid clades.

- Today’s reptiles are all descended from a common ancestor.

- Modern birds, however, are also descended from that ancestor.

- Linnaean class Reptilia, which does not include birds, is therefore not a valid clade.

- Two clades do include the birds: clade Aves, (the birds themselves), and clade Reptilia.

- Therefore, according to cladistics, a bird is a reptile!

**Genes as Derived Characters**

- All organisms carry genetic information in their DNA passed on from earlier generations.

- A wide range of organisms share a number of genes and show important similarities that can be used to determine evolutionary relationships.

**New Techniques Suggest New Trees**

- The use of DNA characters in classification has helped to make evolutionary trees more accurate.

- For example, traditionally African vultures and American vultures were classified together in the falcon family.

- Molecular analysis, however, showed that DNA from American vultures is more similar to the DNA of storks than it is to the DNA of African vultures.

- Often, scientists use DNA evidence when anatomical traits alone can’t provide clear answers.

- For example, giant pandas and red pandas share many characteristics with both bears and raccoons.

- DNA analysis revealed that the giant panda shares a more recent common ancestor with bears than with raccoons.

- Therefore, the giant panda has been placed in a clade with bears.

- Red pandas, however, are in a clade with raccoons and other animals like weasels and seals.